

Sensors

Cryogenic & Non-Cryogenic Liquid Level Instrument

Simplified measurement device using optical transmission properties

NASA's Marshall Space Flight Center has developed a unique prototype for measuring the liquid level in a tank, employing a novel process. The technology can operate in a wide range of environments, including high and low temperatures and pressures, and is simpler and less expensive than other optical sensing techniques. The instrument also provides far greater accuracy and faster results in cryogenic conditions than typical cryogenic liquid metering methods. It is ideal for cryogenic and non-cryogenic ground tank metering applications, and zero-gravity systems that include stratification or settling techniques.

BENEFITS

- ➔ Operates at high and low temperatures
- ➔ Allows accurate liquid level measurements to 0.1% of the optical fiber length
- ➔ Avoids an explosion hazard due to no electrical signals in the tank
- ➔ Rapid response time, up to gigahertz data rates
- ➔ Accommodates snaking through access ports or shaping to fit tank contours

technology solution

THE TECHNOLOGY

NASA's technology provides highly accurate and versatile liquid level metering in a wide range of operating environments. The device for measuring liquid levels in tanks was initially developed for rocket engine testing. Scientists needed to determine the amount of cryogenic liquid that was being used in the testing quickly and accurately; data often very difficult to obtain because such systems usually involve constant mixing between gaseous and liquid states, which can lead to turbulent flow, cavitation, and sloshing.

Other sensors that measure liquid levels in tanks require complicated tank modifications and detection instruments, increasing cost and complexity. Other cryogenic metering systems register the thermal change between liquid and gas fluid phases, limiting accuracy in cryogenic conditions. In contrast to these systems, NASA's device allows operation at high temperatures and pressures in corrosive environments and can precisely measure liquid levels to 0.1% of the sensor length with gigahertz data acquisition rates.



Cryogenic and Non-Cryogenic Optical Liquid Level Instrument for Stratified Conditions

APPLICATIONS

The technology has several potential applications:

- Aerospace - Rocket propulsion testing, engine fuel tanks, cryogenic tanks
- Automotive - Liquid hydrogen fuel tanks, petroleum, gasoline, and liquid natural gas
- Foods and Pharmaceuticals - Contamination-free storage and transportation
- Aviation - Jet engine fuel tanks

PUBLICATIONS

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